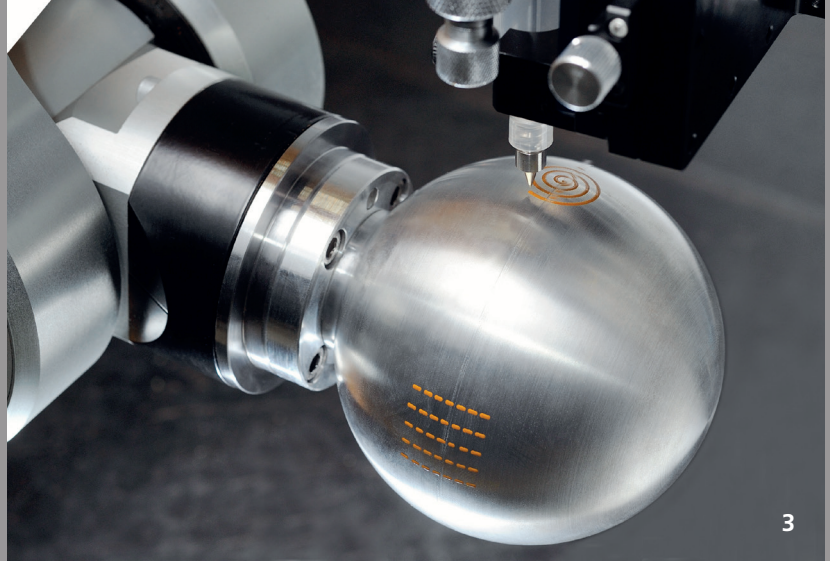

ADDITIVE MANUFACTURING ELECTRICAL FUNCTIONAL LAYERS ON 2D AND 3D COMPONENTS

Task

As the demand for individualized industrial products grows, manufacturing processes are required to efficiently fulfil individual requirements for a product in terms of production technology. Until now, the electrical supply of individual features within an automobile has been ensured by the manual assembly and integration of cable harnesses. Likewise, structural health monitoring (SHM) of components is made possible through manually applied strain gauges. Lock in and lock out as well as manual production processes constitute a major cost factor for the customization of mass-produced products. Digital printing and laser processes offer great potential for cost-effective acceleration of these processes through inline-compatible, reproducible automation. Furthermore, completely new functions can be integrated into a product.

Method

To integrate such functionality into products, Fraunhofer ILT has developed laser processes that, in combination with digital printing processes (e.g. dispensing, ink or aerosol jetting, etc.), make it possible to apply sensors, actuators and conductors on 2D and 3D components. The substrates used are made from metals, optical materials as well as fiber composites. After laser pretreatment to adapt the surface properties, pastes or inks filled with functional particles are deposited onto the component with digital printing methods and then thermally treated using selectively applied laser radiation, resulting in curing, melting or sintering of the previously deposited functional material.

Results

Thanks to digital printing and laser processes, mass-produced products can be customized with functional electrical layers such as insulators or conductors. Compared to those treated in furnace processes, the layers produced have the same or better electrical properties while placing less thermal impact on the substrate material.

Applications

The functional layers produced with digital printing and laser processes can be used in a wide variety of sectors (e.g. automotive, aerospace). Particularly relevant are functional layers for individualized smart products within the scope of the »Internet of Things« as well as »Structural Health Monitoring«. The research presented here is part of the Fraunhofer lighthouse project »Go Beyond 4.0«.

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3 Functional layers on a metal ball produced by means of printing and laser processes.